Federal Aviation Administration

SWIM Prototype Project: EDX Operational Evaluation: NAS Enterprise Domain Data Exchange for SWIM

Presented to:

Demonstration and Prototyping
Information Exchange Briefing

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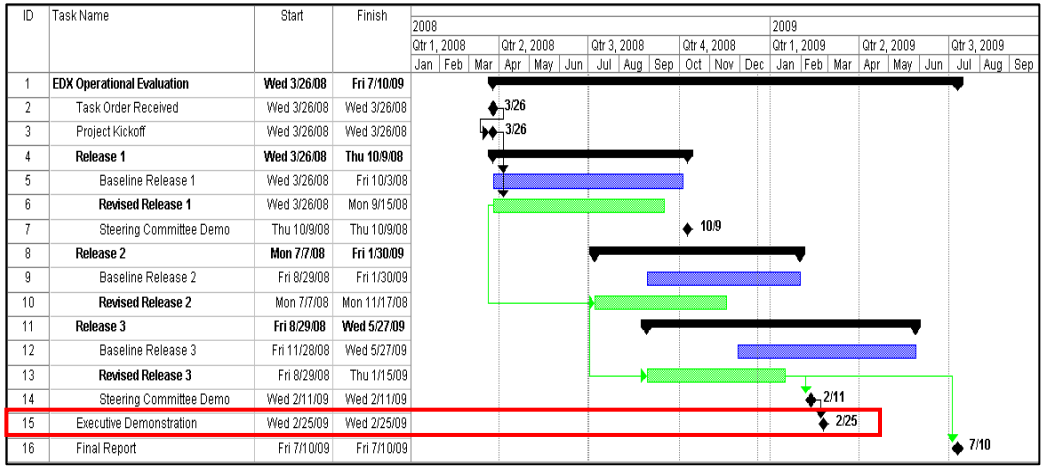
Date: June 3, 2009

Description, Major Players & Milestones

- Background: Team proposed NAS Enterprise Domain SWIM services integrated with the existing NAS IT infrastructure.
- Scope: Operational Eval demonstrating Net-Centric Core Services for SWIM delivered as a shared NAS service
  - For example: FTI currently provides the shared NAS Enterprise Security Gateway service (ED8) which enables non-NAS users to interoperate
- Stakeholders: FTI, SWIM, WARP, ITWS (WJHTC) & Ops Planning Services

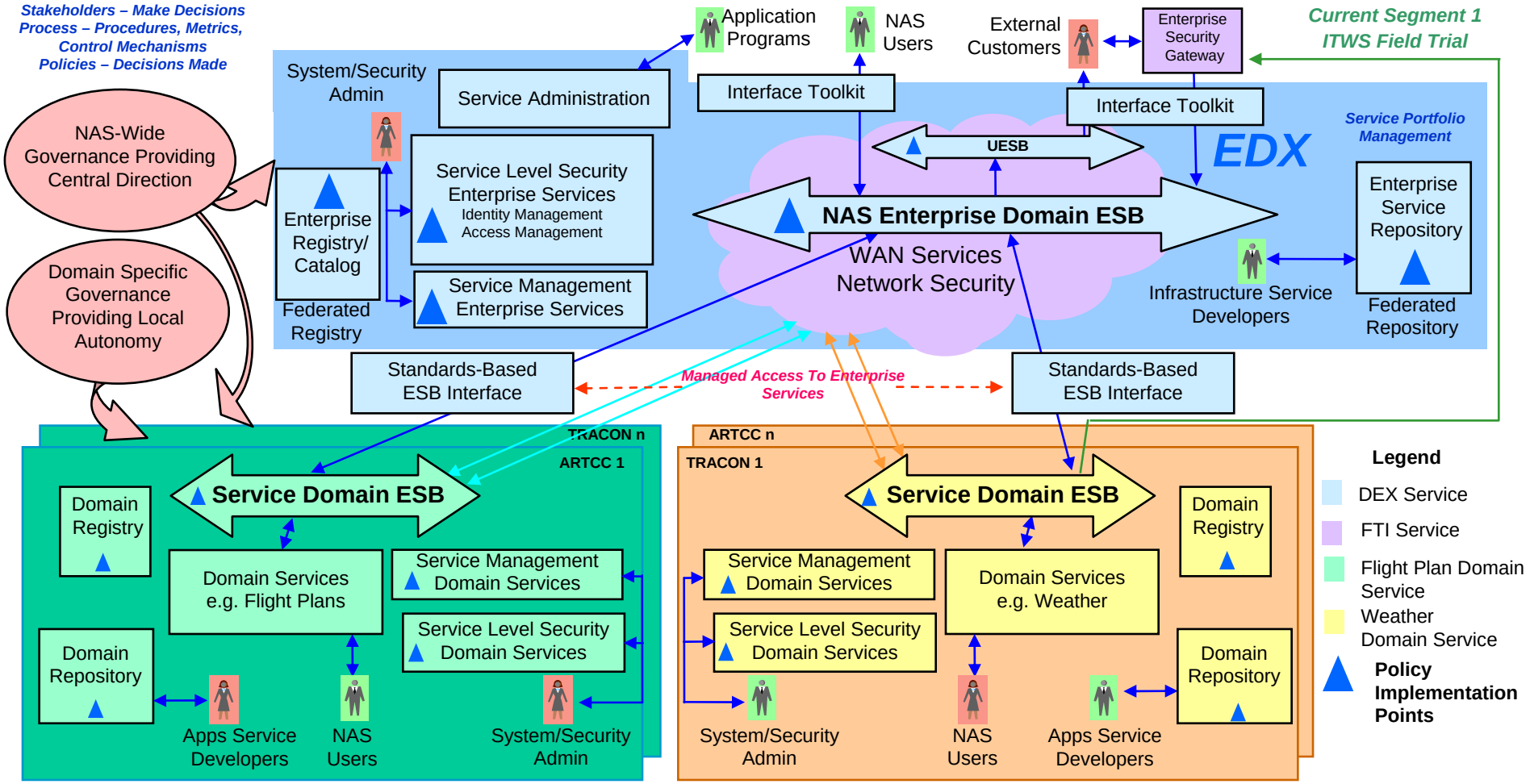


ID	Task Name	Start	Finish
1	**EDX Operational Evaluation**	**Wed 3/26/08**	**Fri 7/10/09**
2	Task Order Received	Wed 3/26/08	Wed 3/26/08
3	Project Kickoff	Wed 3/26/08	Wed 3/26/08
4	**Release 1**	**Wed 3/26/08**	**Thu 10/9/08**
5	Baseline Release 1	Wed 3/26/08	Fri 10/3/08
6	**Revised Release 1**	Wed 3/26/08	Mon 9/15/08
7	Steering Committee Demo	Thu 10/9/08	Thu 10/9/08
8	**Release 2**	**Mon 7/7/08**	**Fri 1/30/09**
9	Baseline Release 2	Fri 8/29/08	Fri 1/30/09
10	**Revised Release 2**	Mon 7/7/08	Mon 11/17/08
11	**Release 3**	**Fri 8/29/08**	**Wed 5/27/09**
12	Baseline Release 3	Fri 11/28/08	Wed 5/27/09
13	**Revised Release 3**	Fri 8/29/08	Thu 1/15/09
14	Steering Committee Demo	Wed 2/11/09	Wed 2/11/09
15	Executive Demonstration	Wed 2/25/09	Wed 2/25/09
16	Final Report	Fri 7/10/09	Fri 7/10/09

- Deliverables: Information Exchange
  - Rel 1: Basic Net-centric Core Services & **Weather product distribution** via pub/sub services (Oct 08)
  - Rel 2: Extended Core Services & **NEXRAD** weather product distribution to **ITWS**, message transformation to **web services** (Nov 08)
  - Rel 3+: Advanced Core Services & **WARP's federated ESB**, **ERAM/weather overlay** (Jan 09)

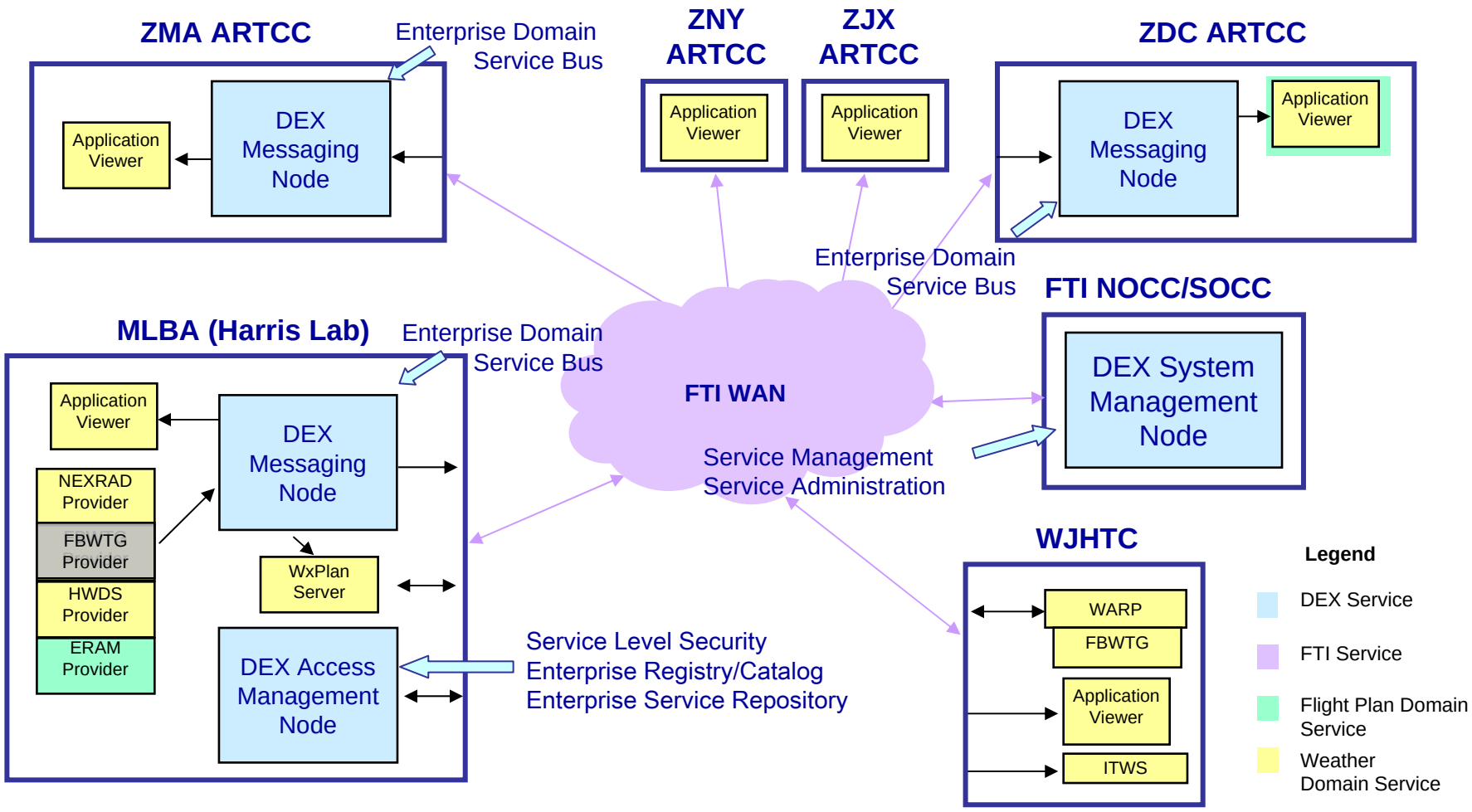
FTI EDX Op Eval demonstrates a NAS Enterprise Domain tier for establishing a shared services model for SWIM.

EDX Notional Architecture



Flexible two-tier architecture enables Service Domains to make services available across the FAA enterprise through Shared Services. Architecture scales with migration to NextGen.

EDX Op Eval Deployment Model

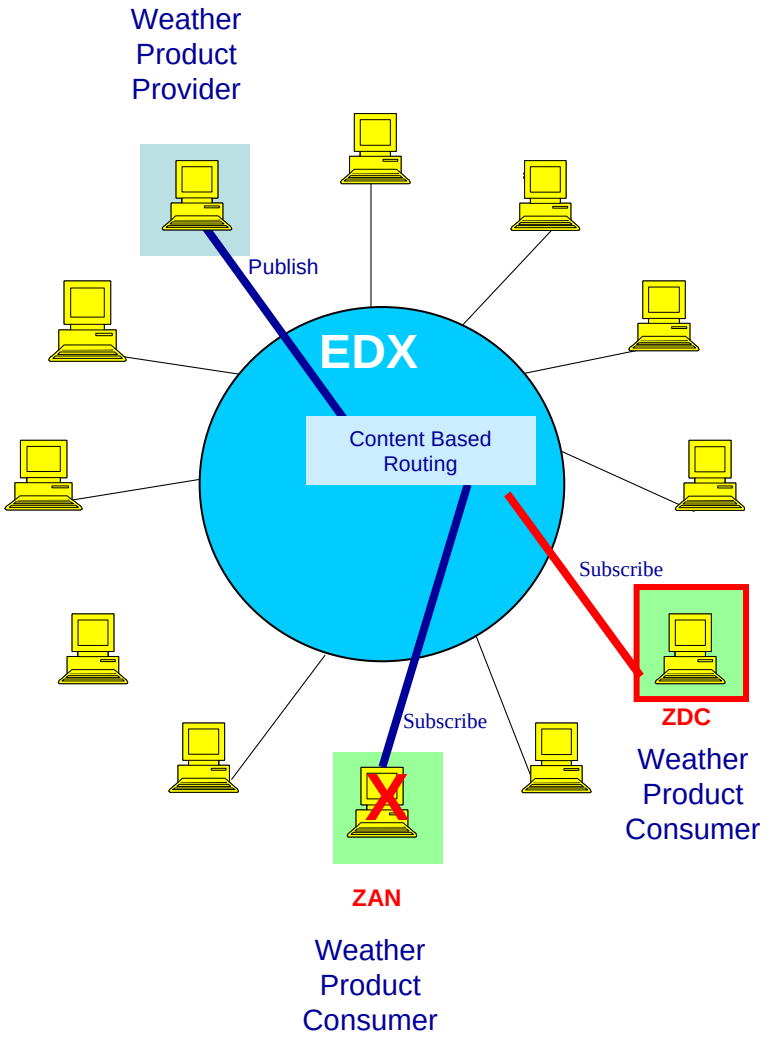


EDX IT Infrastructure Deployed on FTI Operational IP Network, Demonstrating real systems & real data.

Milestones Achieved

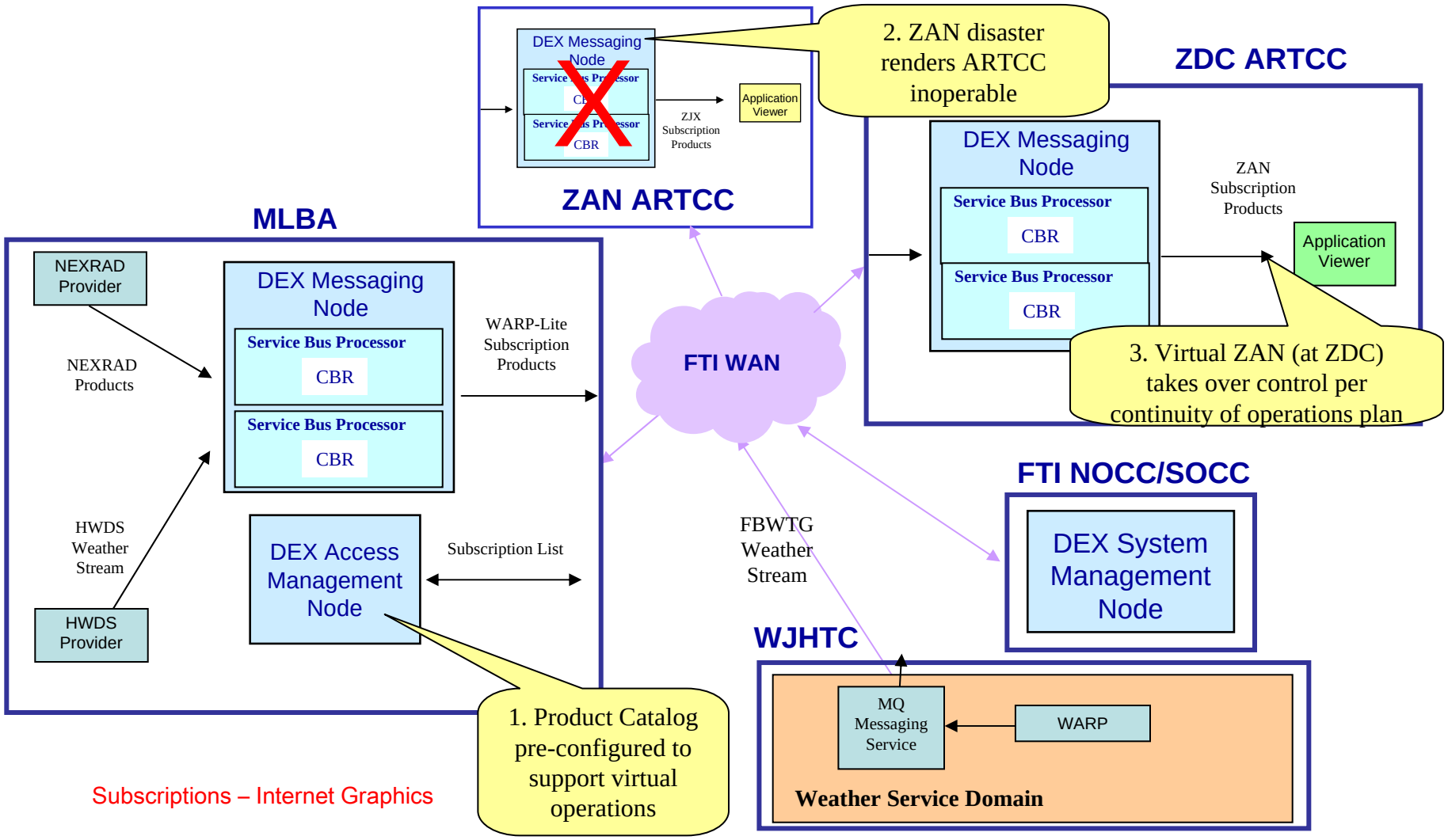
- **Delivered 4 Releases in 10 months (Plan: Rel 1, 2 & 3+ in 14 months)**
  - Releases supported weather content distribution, changing authoritative sources, ESB transformation & collaboration with LM on-ramping FDO
- **Demonstration scenarios to FAA Executives completed: 4/8 & 4/9/09**
  - R1-R3 Evaluated alternative SOA integration concepts with IT infrastructure
  - Weather Products via Pub/sub and Web Service Delivery Mechanisms
    - Interoperability, network awareness & minimize risk
  - Supporting Common Operations Picture:
    - Leverage existing investment in Security & Operations management capabilities
  - Continuity of NAS Operations: BCP Scenario: ARTCC Failure/WJHTC becomes ARTCC
  - Rapid On-ramping of Providers and Consumers
    - Demonstrated how once an existing service domain publishes content (LM ERAM) & exposes to NAS Enterprise Domain tier, other service domains can acquire, ingest & integrate new services
  - SOA Design-time Governance: Applying FAA defined NAS-wide policy enforcement
- **Gathering lessons learned:**
  - EDX Environment is CM controlled & uses FTI deployment processes
    - Can build any node from scratch within hours & used HSV Lab for interoperability analysis & test
  - Vendor independent implementation: Release 1: IBM, Release 3: Oracle
- **EDX Release 4: Currently under development – July deployment**
  - Integrate ITWS prototype w/ NAS Enterprise Domain through boundary protection

Example:
Continuity of NAS Operations: Overview



- **Description**
  - Anchorage ARTCC is inoperable due to disaster & NAS applications are migrated to the Tech Center (ZDC) per business continuity plan
- **Capabilities**
  - DEX Navigator – enables configuration of subscriptions in support of application migration
  - Content Based Routing – routes information to migrated application based on its content
- **Benefits**
  - Supports virtual ATM operations from any control center supporting continuity of operations
  - Supports migration to NextGen Future Facility initiatives

Service Level Management/Continuity of NAS Operations: Demonstration Scenario



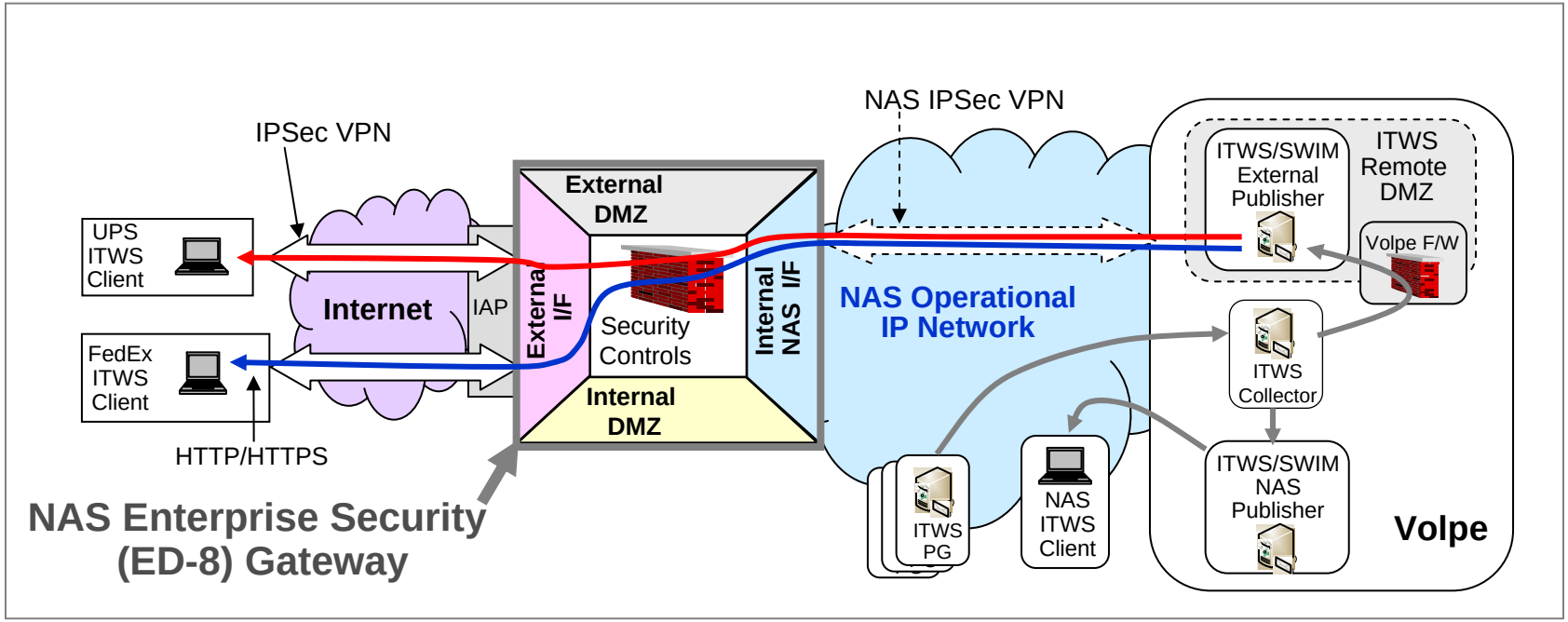
EDX Roadmap - Release 4

- NAS Enterprise Security Gateway – Provides un-trusted ESB for simplified access to NAS products by external consumers
- ITWS Interoperability – Ease of bringing SWIM Segment 1 Service Container based providers into the DEX
  - Provides a Service Container adapter to Interface to DEX.
  - Provider does not have to be modified.
- Geo-carving: Provide subset of RUC model to consumers
  - Weather IRAD
  - User creates request, ESB send request to Geo-carving Service, ESB routes data to destination
- Expansion of Core Service capabilities
  - High Availability persistent messaging support via ESB – pre-requisite for guaranteed message delivery
    - Clustering capability using WLS & Messaging service migration
  - Service Monitoring & Metrics: NOCC integration and consolidated service monitoring, highly available monitoring
    - NOCC Integration: provides consolidated monitoring of all distributed DEX nodes

EDX Roadmap - Release 4 (cont.)

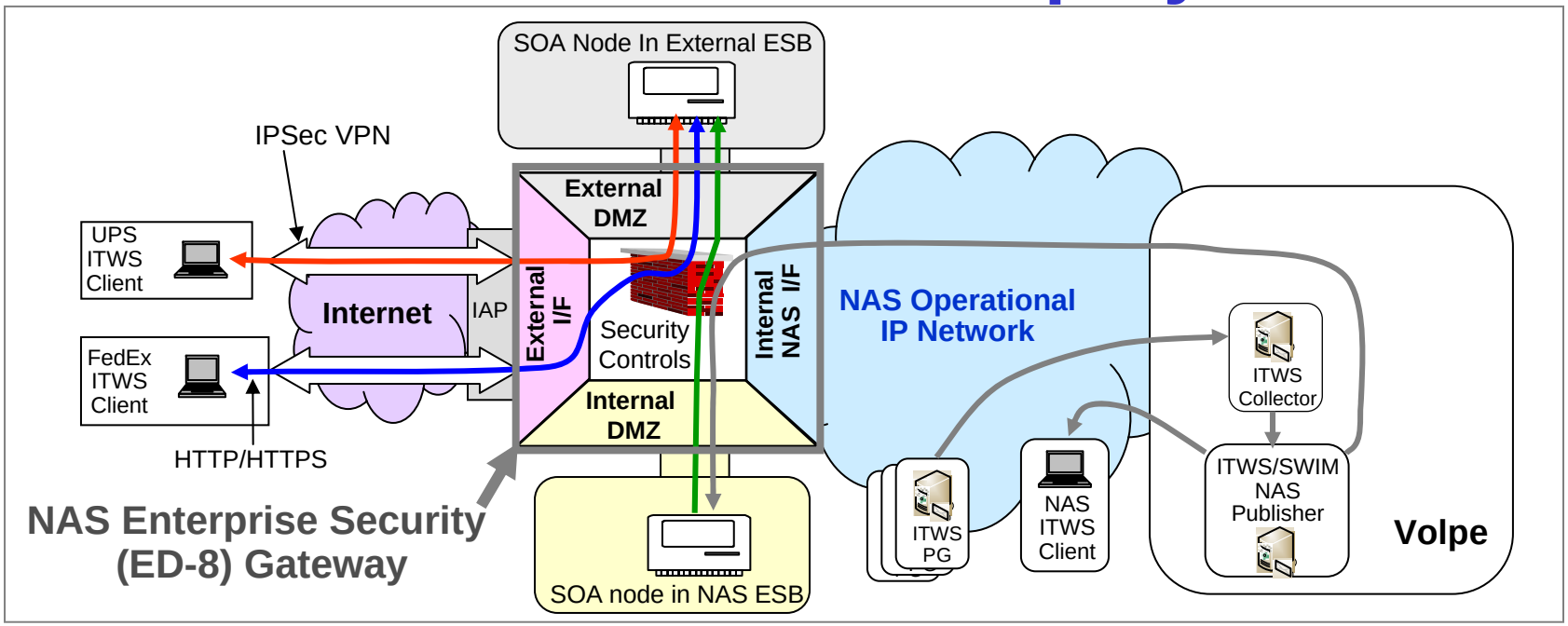
- Expansion of Core Service capabilities (cont.)
  - Service Level Security – Policy driven consolidated DEX Security management
    - Provide access control at the service level using consolidated policy manager
  - High Availability Database – Provides highly available message routing engine & product catalog access
    - Clustered product catalog and message routing databases
  - Performance Improvements – Reduced message latencies
    - Database tuning & Server side caching of message routing tables
  - DEX Navigator Enhancements
    - Manage web service endpoints for pub/sub consumers
    - Select subscriptions from web service
    - View summary of all current consumer subscriptions
  - Enhanced DEX JumpStart Kit – Flexible adaptor pattern for Providers & Consumers
    - Allows for rapid deployment of new provider and consumers for the DEX platform
  - Registry – Increased service maintainability
    - Runtime usage strategy utilizing proxies for flexible service management
    - Supports virtual service endpoints
  - Repository – Increase service governance
    - Publish services and endpoints from design-time repository to the run-time registry
    - Discovery of run-time proxy services and endpoints on the ESB and ingest to the repository so that they can be governed

SWIM ITWS "As Is" Prototype



- ITWS currently operates a remote DMZ at Volpe
  - External FES used to provide SOA service for external users
  - ITWS Security controls required to segregate SOA FES from NAS
- Each External user requires an association with ITWS provider
  - Separate data flow required for each external user
- NAS Enterprise Security Gateway provides Boundary Protection
  - Terminates/Authenticates each external user and proxies TCP connection

EDX Rel 4 End State Deployment



- Boundary Protection **of NAS Services provided as NAS Infrastructure**
  - NAS systems on-ramp to NAS Enterprise Domain Tier SOA node
  - NAS infrastructure provides all required security controls
- Governance still required to match service authorization credentials
  - NAS Governance authorizes external users for specific NAS services
  - NAS SOA services identify/authenticate user and map to authorized services

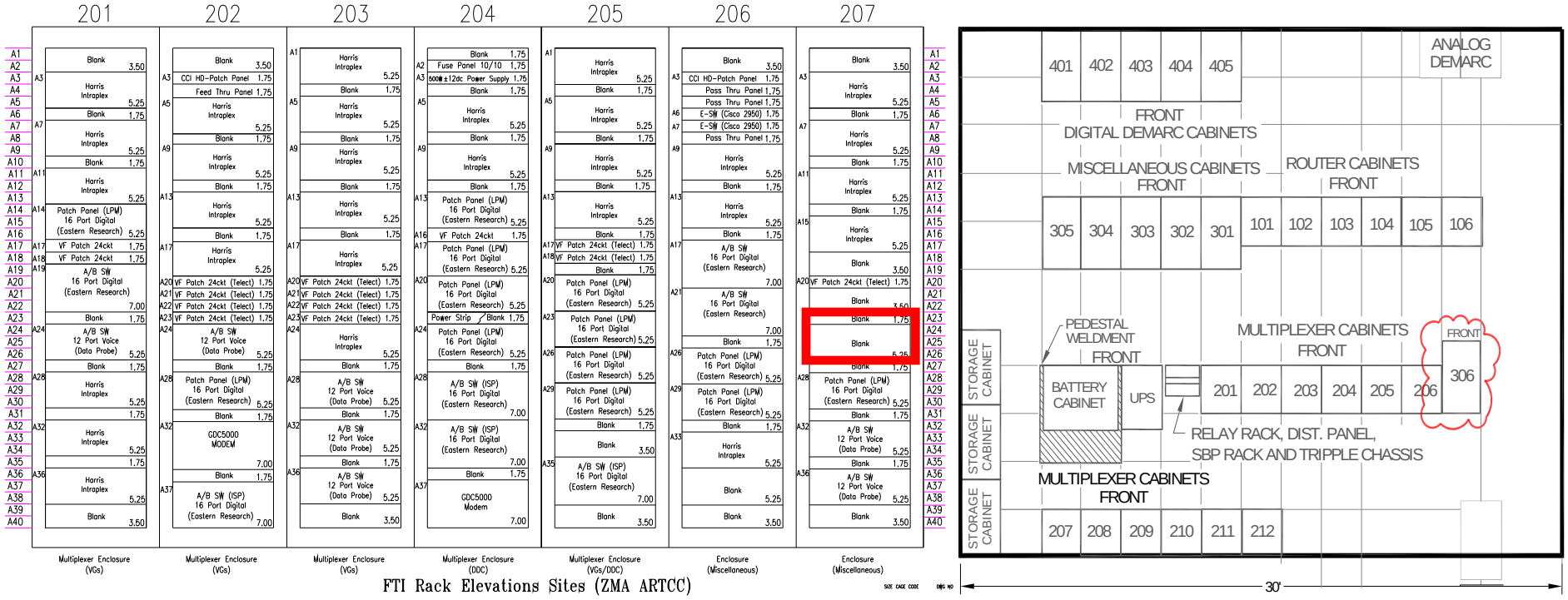
Benefits

- **EDX is demonstrates:**
  - A shared services capability where Service Domain content is made visible, accessible and interoperable with COI's across the NAS
  - Value of NAS Enterprise Domain tier for data exchange
    - The flexibility to have Service Domains control their own operations
    - Sharing assets (IT infrastructure & information) across FAA Enterprise
    - Rapid integration from available content
  - How FAA can leverage existing operations and management assets, as well as monitoring/maintenance assets
- **EDX Release 4 continues to validate shared data exchange concept of operations, known as the DEX**
  - Cost effective solution for sharing information with external NAS stakeholders, within the context of NAS boundary protection & FAA security policies
  - Re-usability: Once on-ramped, ITWS content will be available (internal & external) to all authorized NAS users
  - EDX R4 demonstrates FAA enterprise governance of content across the NAS
- **Environment & capability that can be leveraged for other research & development activities**

Backup

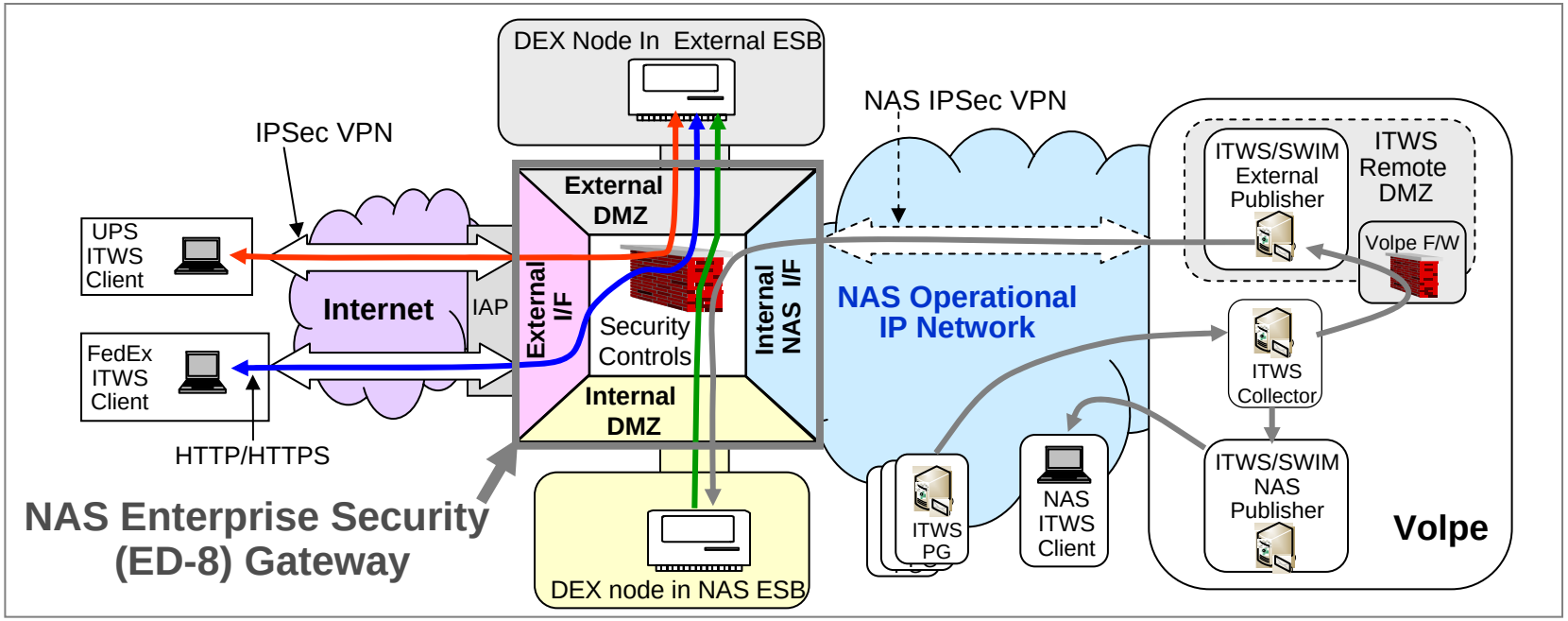
EDX: Implemented in NAS

- **SOA infrastructure deployed in FTI Operational footprint**
  - TestNCP: completed and valid for on-going activities
  - IT systems racked in FTI rack space
  - Network services provisioned to support data service requirements



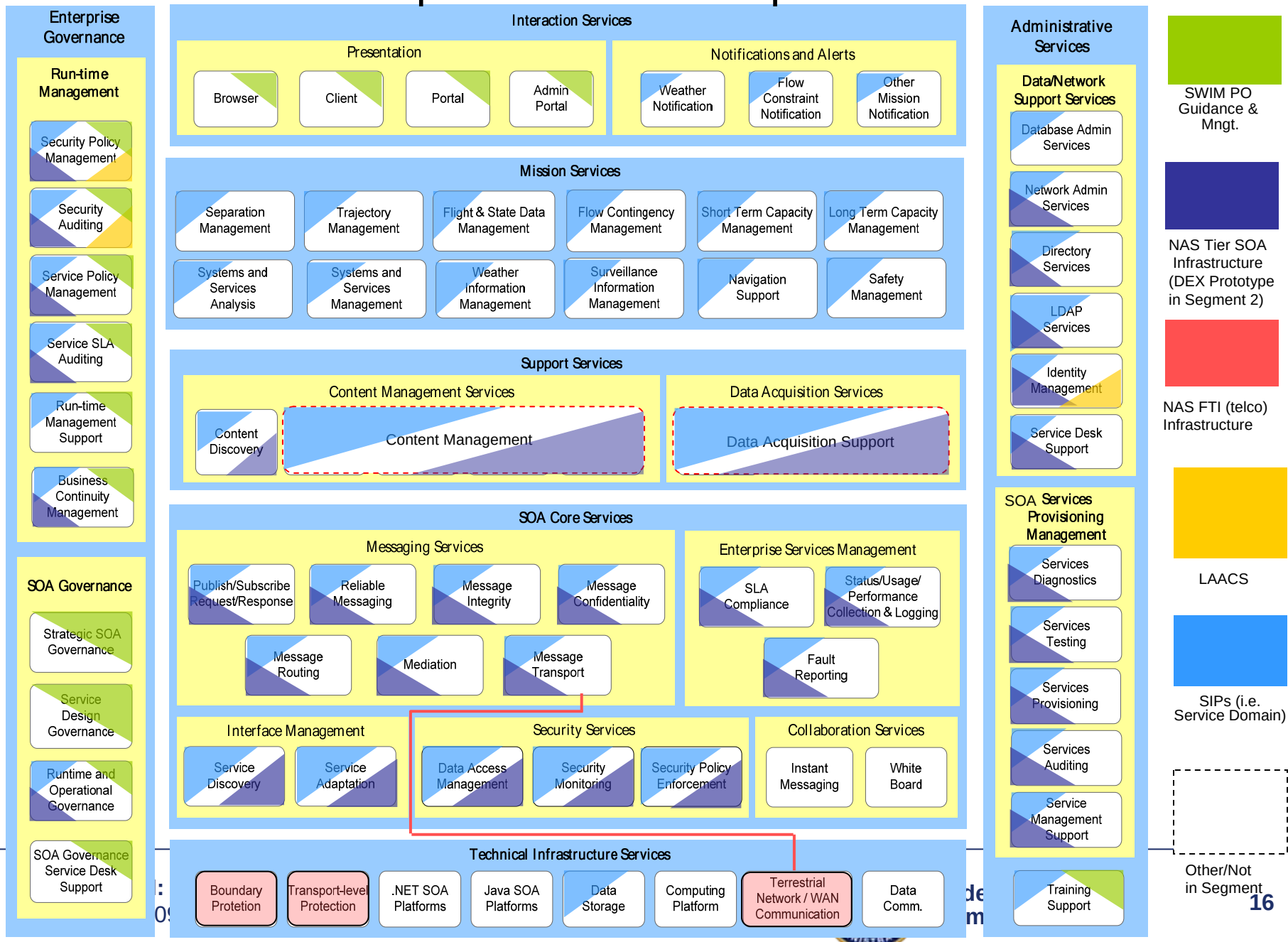
FTI Rack Elevations Sites (ZMA ARTCC)

EDX/NAS-SOA Release 4 Demo



- Infrastructure DMZs and NAS Boundary Protection maintained at Ingress for use by all NAS systems to maintain integrity of NAS Network
  - DMZs separated by appropriate security controls
- Improved scalability: Only one copy of service data required at gateway
- Promotes single MOA with external users for all NAS interfaces
- Remote DMZ and special External Publisher at Volpe are no longer required

SWIM Potential Implementation Responsibilities



EDX Roadmap: Release 2

Release 2 (15 Sept – Final SW delivery, 15 Oct - Available to FAA)

- NEXRAD Publisher/ ITWS Consumer
- Expansion of Core Service capabilities:
  - Service Monitoring and Metrics – ESB and web services
  - UDDI Registry – use registry to register web services and access service address at runtime.
  - JMS to web service conversion – use ESB to convert JMS message to SOAP message and invoke a web service to display content. Provide ITWS web service to consume NexRad data.
- Stretch Goals:
  - Governance – ALER design capture

EDX Roadmap: Release 3

Release 3 (5 Dec – Final SW delivery, 15 Jan - Available to FAA)

- WARP Publisher – enable the WARP system to publish products through ESB.
- Expansion of Core Service capabilities
  - High Availability messaging via ESB – add load balancer, shared disk and clustering capability using HA product.
  - Service Level Security – provide access control at the service level
  - Service Monitoring and Metrics – enhanced capabilities
  - BEA – IBM ESB bidirectional JMS – interoperability between ALSB and MB
  - Product Catalog/CBR Enhancement – increased automation of product management
  - Performance Instrumentation – data driver and monitoring/measurement tools

FTI Enhanced Data Service – X (EDX)
Net-centric SOA-based Data Exchange

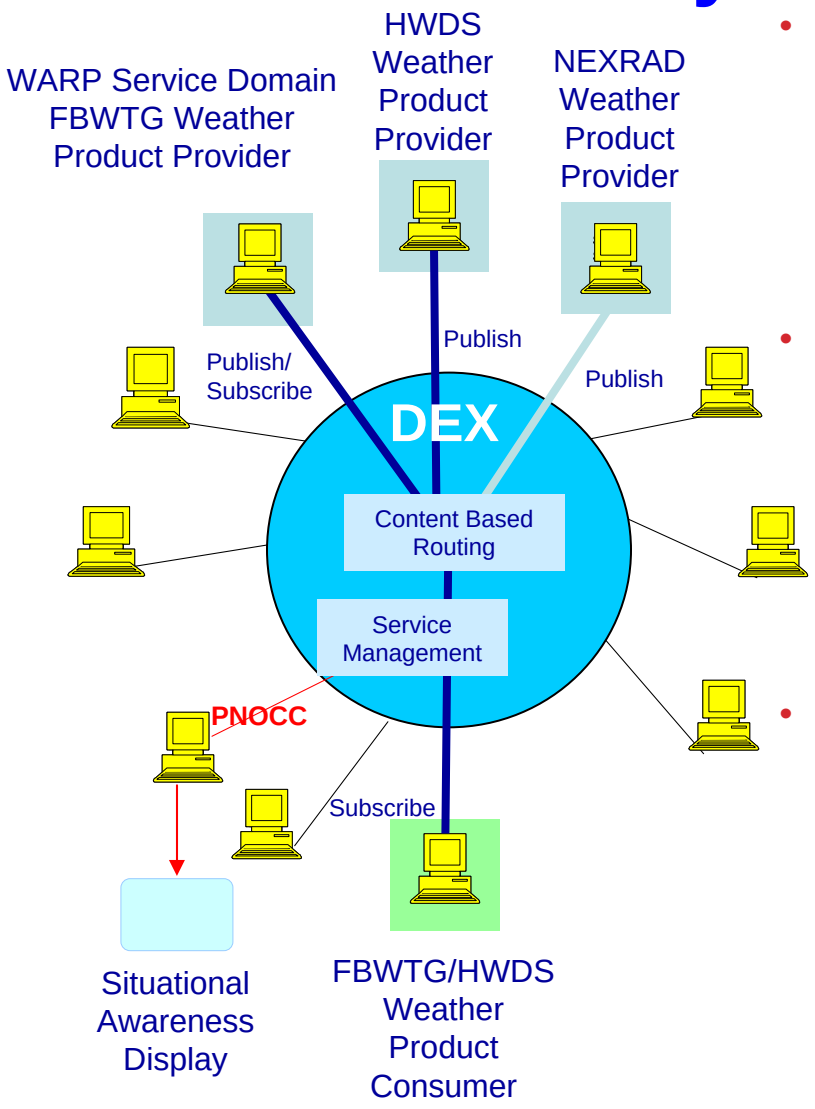
EDX Operational Evaluation

April 9, 2009

EDX Operational Evaluation Demonstration

- *Scenarios*
  - *Weather Products via Pub/sub and Web Service Delivery Mechanisms*
  - *Supporting Common Operations Picture*
  - *Continuity of NAS Operations*
  - *Rapid On-ramping of Providers and Consumers*
  - *SOA Design-time Governance*

Weather Products via Pub/sub & Web Service Delivery Mechanisms: Overview



- **Description**
  - WARP Service Domain publishes FBWTG weather products & receives subscribed HWDS data
  - HWDS weather provider publishes weather product streams
  - NEXRAD weather provider publishes NEXRAD
  - Redundant Messaging Node processor fails & messaging capabilities continue
- **Capabilities**
  - DEX Navigator – product catalog browsing and subscription management
  - Product Catalog – portfolio of DEX products and associated metadata
  - Content Based Routing – router that routes information to consumers based on its content
  - Service Domain interoperability via Master ESB mediation
  - Clustered Messaging Node provides fault tolerance
- **Benefits**
  - Enhanced awareness – delivers the right product at the right time with the required service level
  - Optimizes network bandwidth utilization
  - Flexible data sharing to support evolving NextGen requirements: Service Domain interoperability
  - Provides increased awareness of NAS operations
  - Enables FTI asset & SLA model re-use for increased NAS service level monitoring

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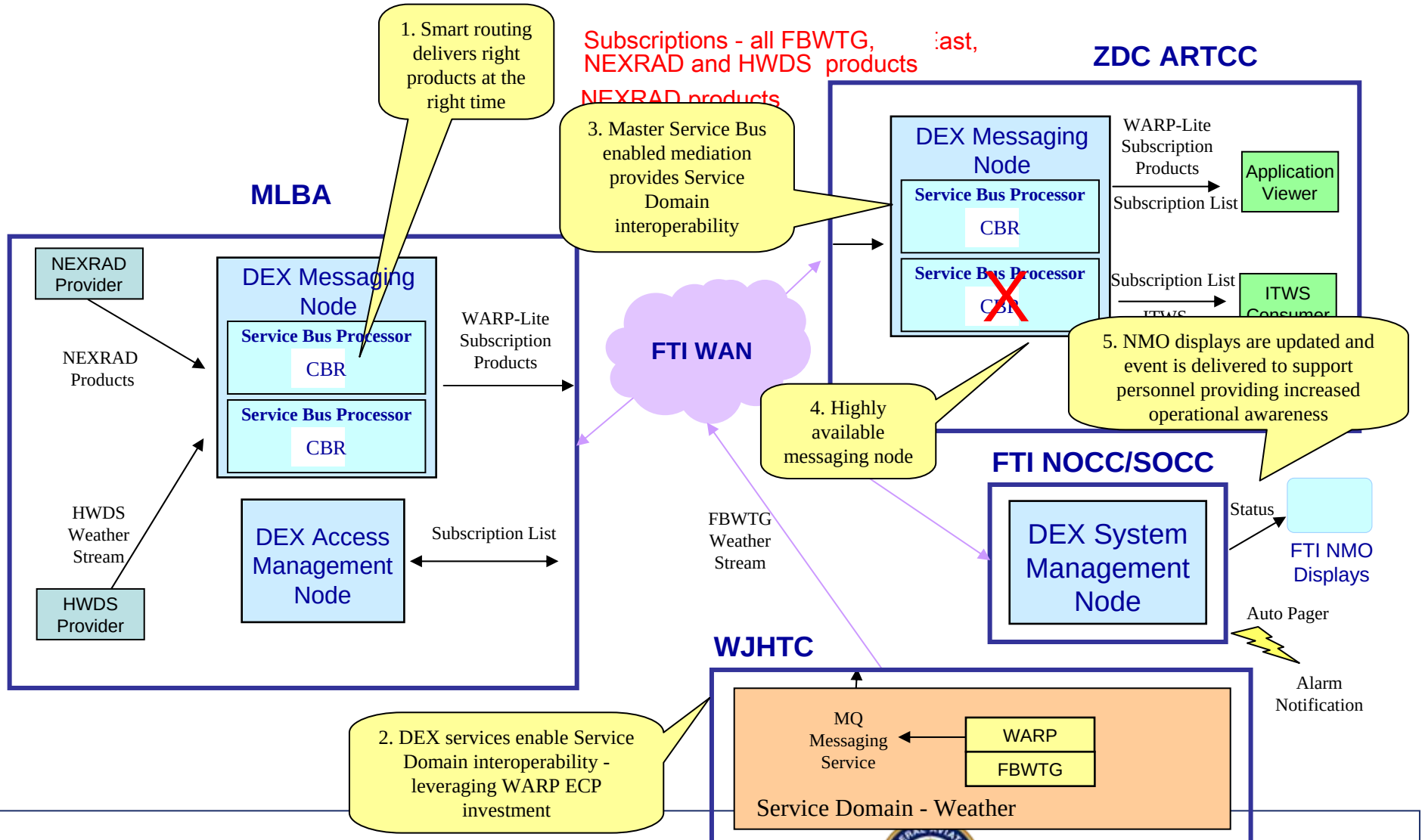
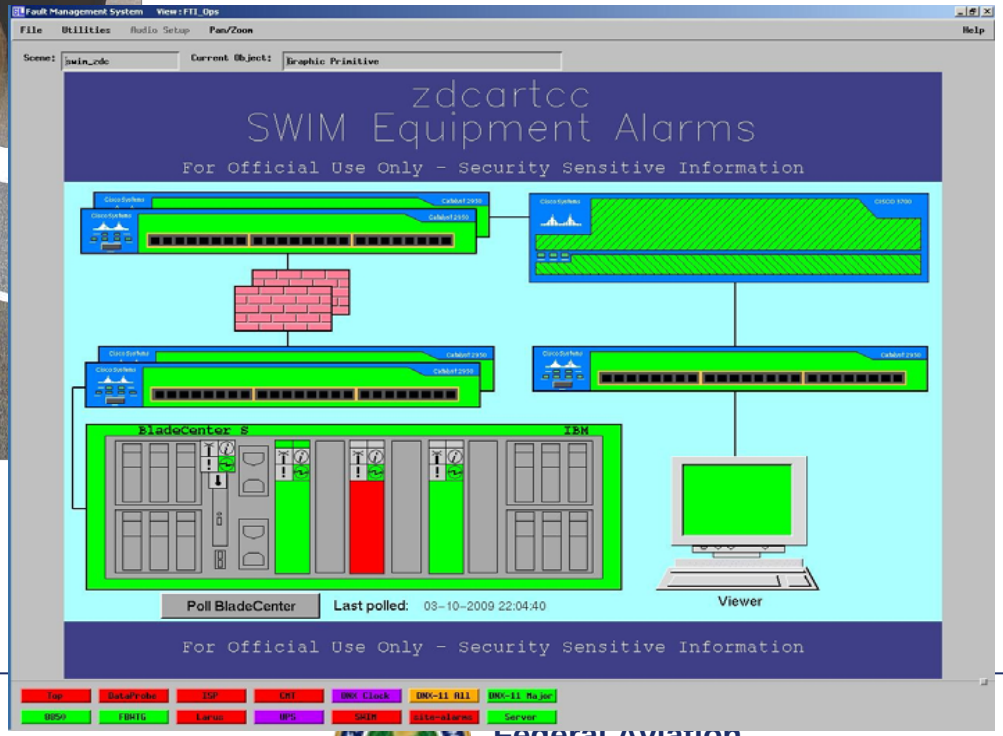
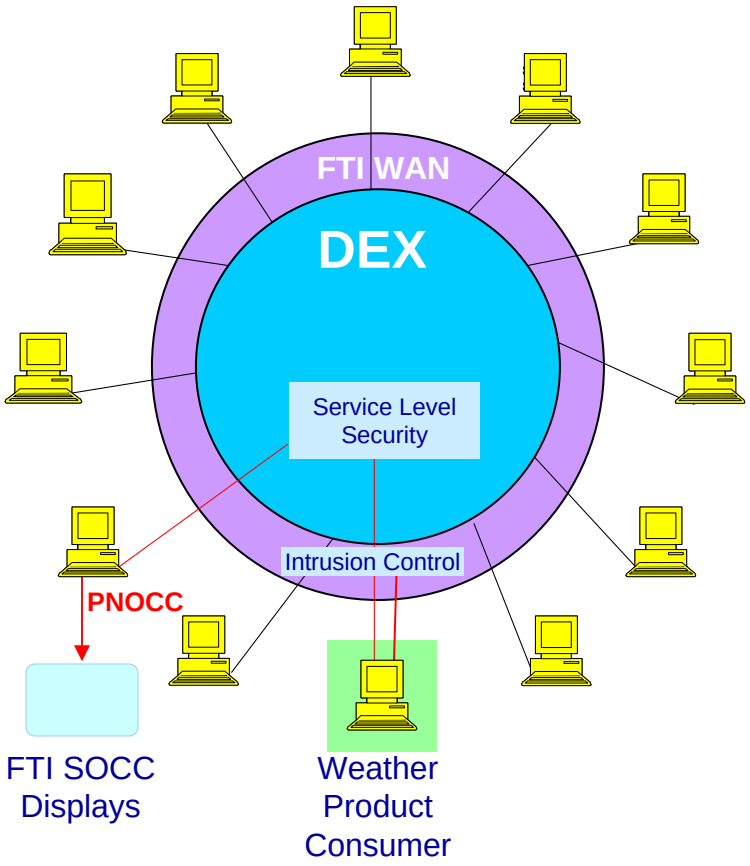


NOCC Situational Display

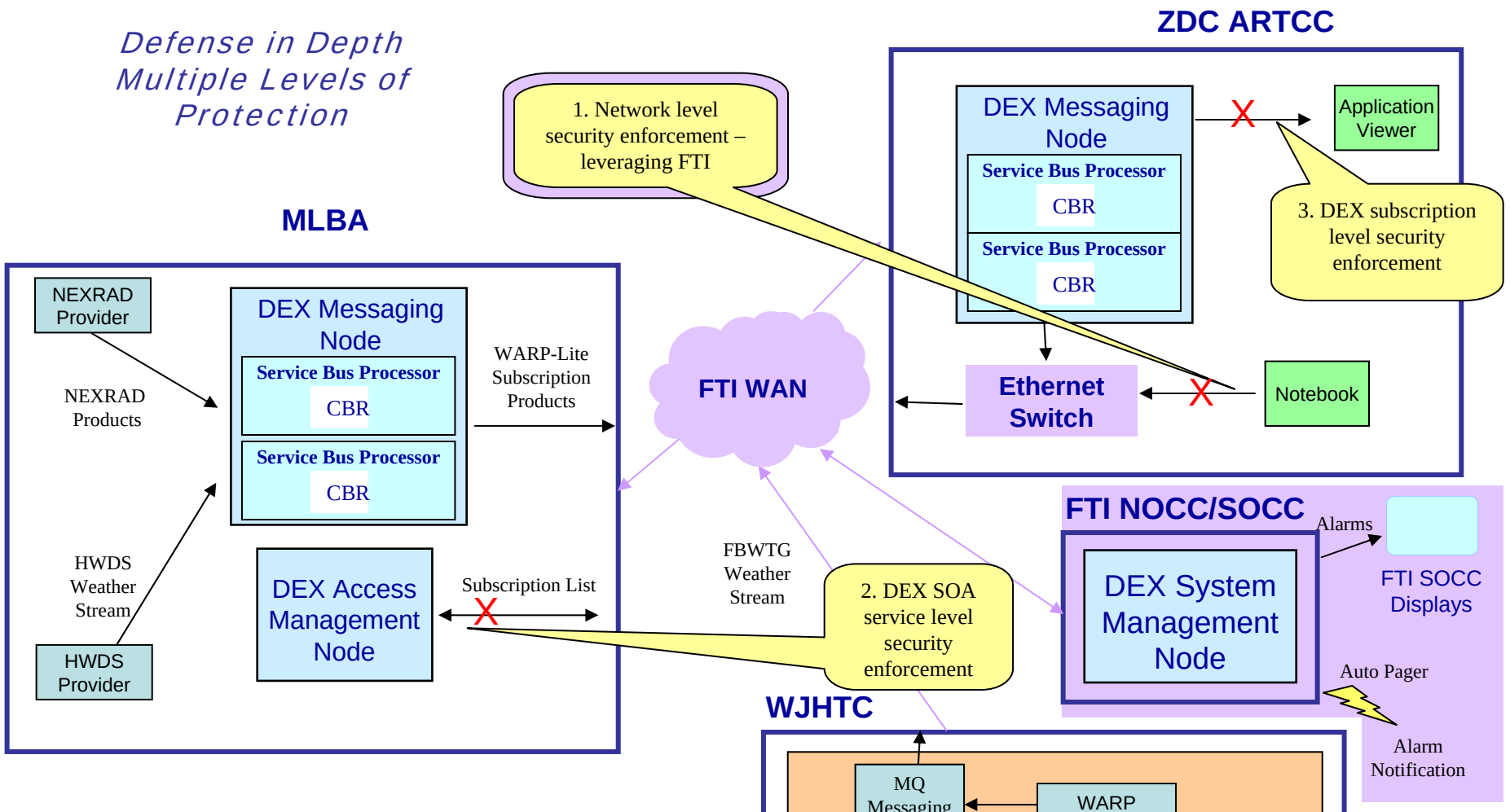


Supporting Common Operations Picture: Overview

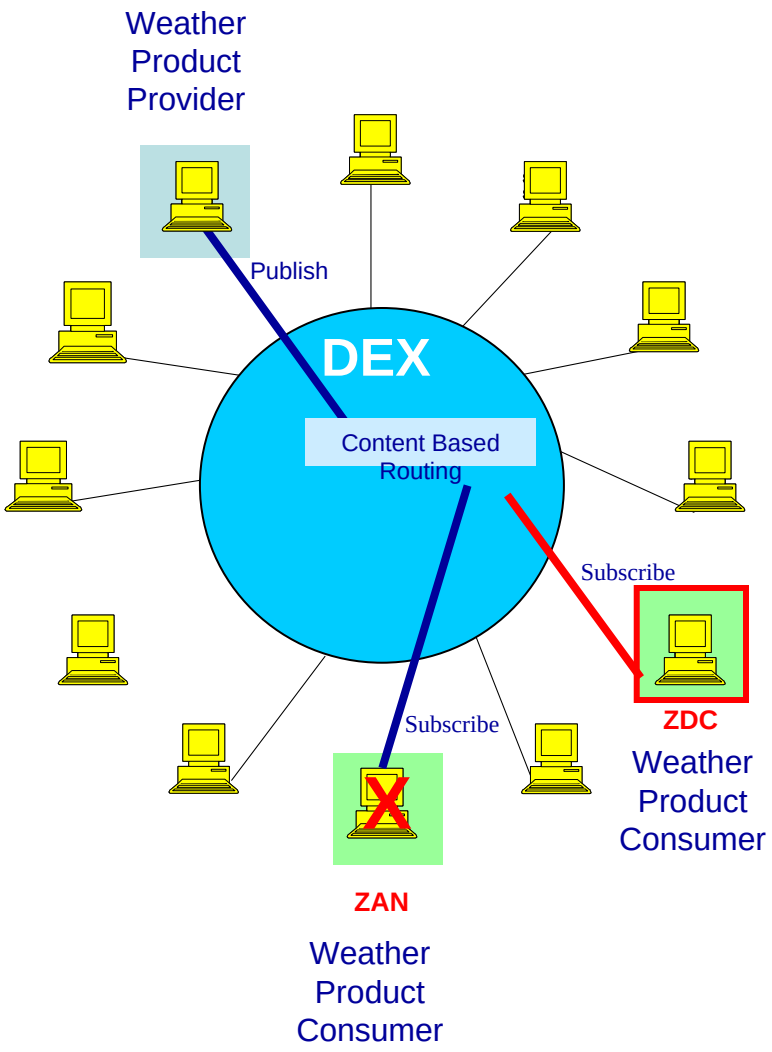


- **Description**
  - Access to DEX services & FTI network services are controlled via policy based management
  - Unauthorized access to DEX services will be detected & denied with associated alerts generated
- **Capabilities**
  - Product Access Security – product catalog access control and consumer access control
  - Intrusion Control – network & DEX component intrusion detection
- **Benefits**
  - Net-centric security architecture offers multi-layer common operations picture
  - Protects NAS via FAA certified FTI architecture offering NextGen risk reduction

Supporting Common Operations Picture: Demonstration Scenario



Continuity of NAS Operations: Overview



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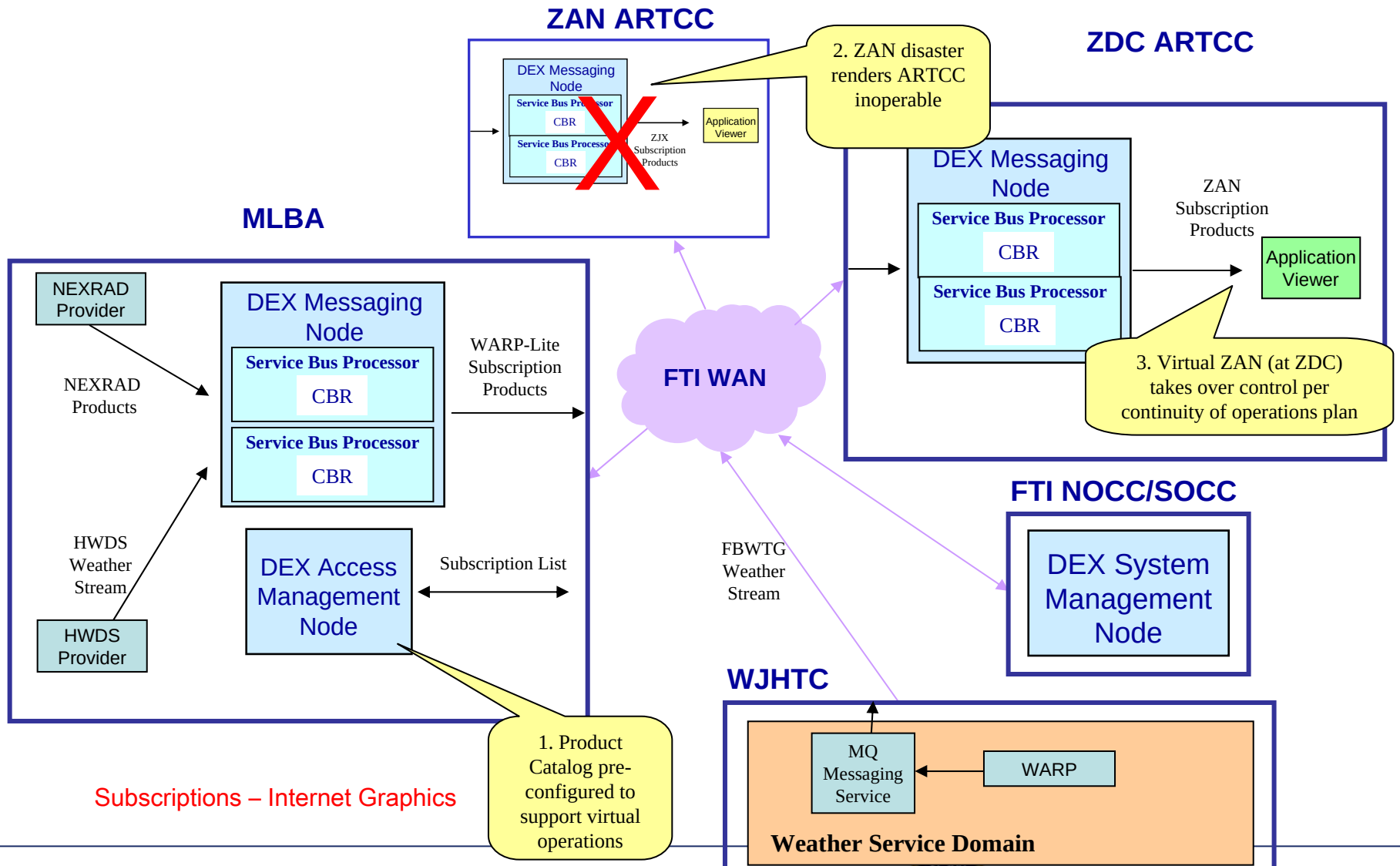
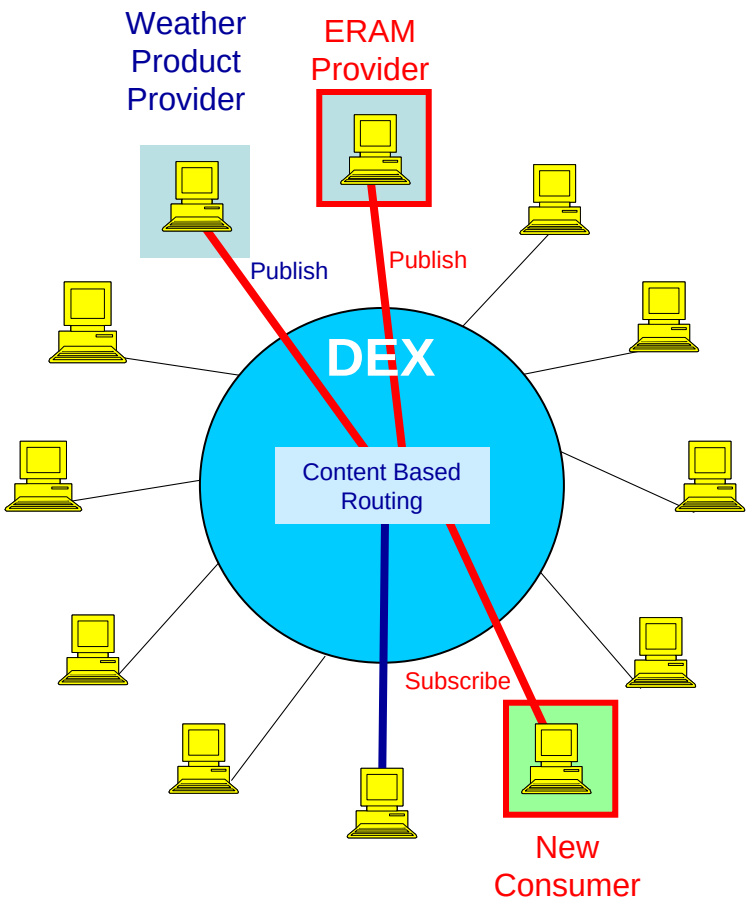
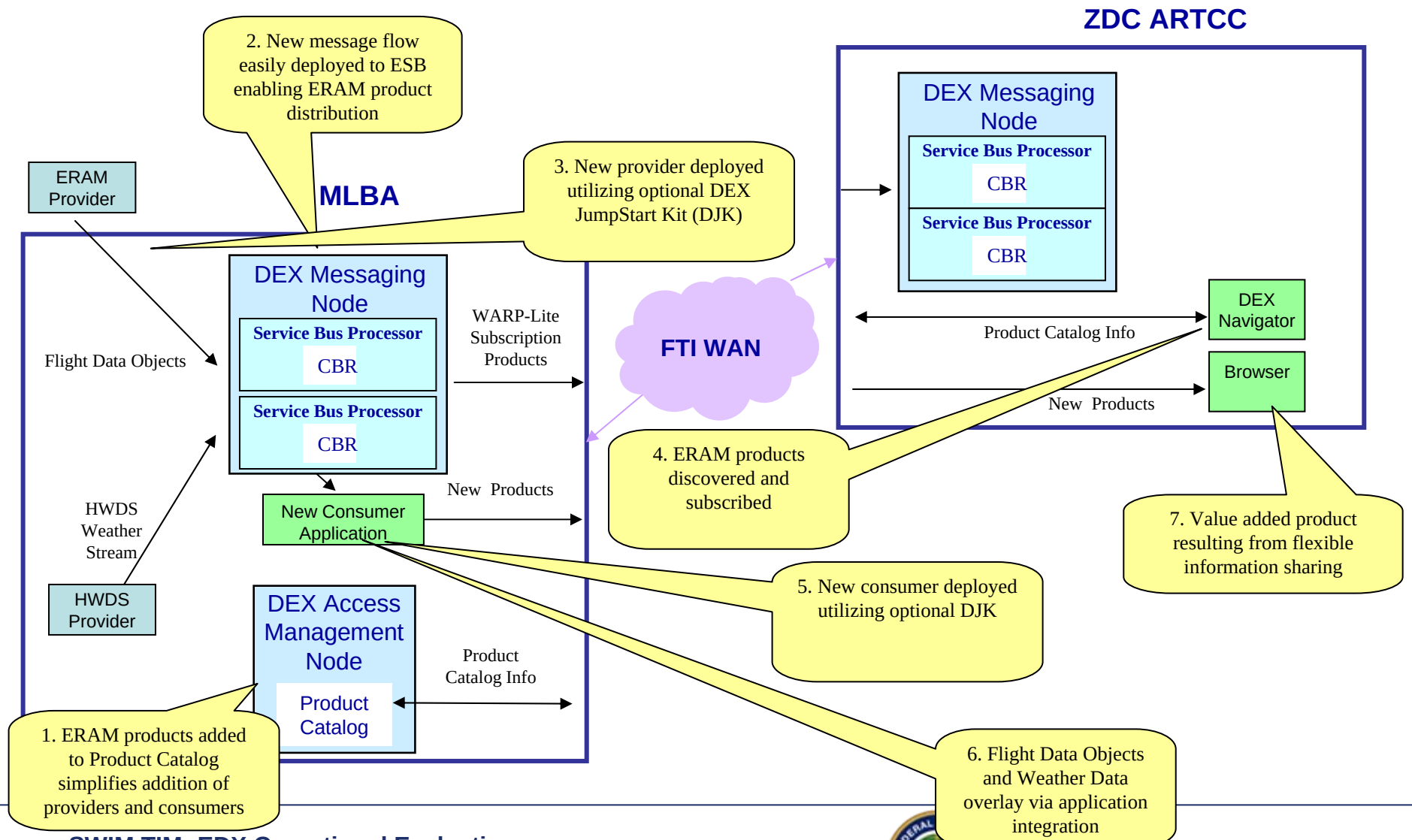


Rapid On-ramping of Providers & Consumers: Overview



- **Description**
  - A new ERAM provider is deployed to the DEX with no modifications to ERAM software (XML encoded Flight Data Objects)
  - A new consumer is deployed to the DEX
- **Capabilities**
  - DEX Navigator – product catalog browsing and subscription management
  - Product Catalog - portfolio of DEX products and associated metadata
  - Content Based Routing – router that routes information to consumers based on its content
- **Benefits**
  - Rapid on-ramping of new providers & consumers provides increased NAS agility
    - Application Integration
  - Flexible information sharing to support evolving NextGen requirements

Rapid On-ramping of Providers & Consumers: Demonstration Scenario

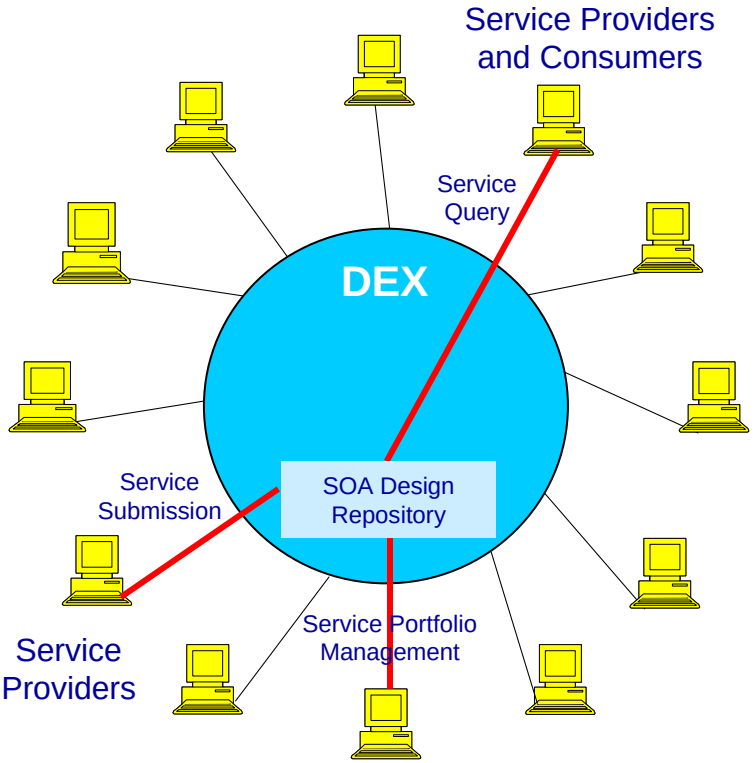


SOA Governance - Overview

Key Steps Toward Effective SOA Governance

- Define Goals, Strategy and Constraints
- Define Policies and Procedures
- Define Metrics for Success
- Put Governance Tools in Place
- Analyze and Improve Processes
- Refine Your SOA

The focus of today's demonstration



- **Description**
  - Service portfolio management capabilities are demonstrated
- **Capabilities**
  - Service standards compliance and technology dependency
  - Service COTS utilization
  - Service relationships and interdependencies
  - Service provisioning support
- **Benefits**
  - SOA Governance is required & centrally managed shared services enables consistent policy enforcement
  - Improves impact analysis effectiveness over a federated governance enforcement model
  - Promotes and optimizes service reuse

Net-centric Shared Core Services: Demonstrations – Benefits Summary

Net-Centric Core Services	*FAA Benefits*
Net-centric Architecture & Operations	• ***NAS Agility: operational flexibility in enterprise data sharing & interoperability*** • ***WAN & infrastructure optimization: supports multiple failure modes (lower cost)*** • ***Enterprise view eliminates "virtual point-to-point" message exchange***
Centralized Administration & Management	• ***Increased enterprise-wide awareness, consistent application of NAS-wide policy management & re-use existing "defense-in-depth" security architecture investment*** • ***IT/WAN Scalability: supports incremental expansion, NG transition risk reduction***
Lowest Total Cost of Ownership (TCO)	• ***Deployment: IT infrastructure used as shared services, ensures NextGen migration through incremental investment & eliminates underutilized infrastructure*** • ***Maintainability: Leverages investment in existing enterprise-wide operational shared services, maintenance & avoids costly mass system-wide upgrades***
Demonstration Scenarios	*Benefits Demonstrated & Relevance to NextGen (NG)*
Weather Products via Pub/sub & Web Service Delivery Mechanisms	• ***Interoperability: Pervasive data availability supports evolving NG requirements*** • ***Network Awareness: right products, to the right people at right time*** • ***Shared services maximizes IT re-use, investment & minimizes NG transition risk***
Supporting Information Assurance Common Operations Picture	• ***Enterprise awareness: Net-centricity leverages multi-layer FAA certified security*** • ***NG risk reduction: Consistency in NAS-wide information assurance policies***
Flexibility of NAS Operations	• ***Operational flexibility: supports virtual ATM Ops for CoOP & NG Future Facilities*** • ***Re-usability: Enables re-use of FTI asset & SLA model for new NAS services***
Rapid On-ramping of Providers & Consumers	• ***Re-usability: Data visibility & accessibility accelerates application integration*** • ***Adaptability: No code modifications required from the source (lower cost & risk)***
Governance	• ***Centrally managed shared services enables NAS-wide policy enforcement***

Net-centric Shared Services demonstrated through The DEX Accelerates Evolution to NextGen